JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. XI No 2, Maret 2025, hlm. 313 – 320 ISSN 2550-0201 (Online)
DOI: http://dx.doi.org/10.33330/jurteksi.v11i2.3639
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

PLANTATION COMMODITY SELECTION IN CENTRAL JAVA USING MABAC METHOD AND PSI WEIGHTING

Andini Ayu Nurhaliza[1*], Saifur Rohman Cholil[1]
[1]Sistem Informasi, Universitas Semarang
email: *andiniayu@gmail.com

Abstract: Central Java has significant potential in the plantation sector with various commodities such as pepper, cloves, tobacco, tea, sugarcane, coffee, nutmeg, and patchouli. However, the abundance of commodities does not guarantee that all of them provide maximum benefits. This study aims to recommend the most potential plantation commodities for development. The research utilizes plantation data from Central Java over the past few years, obtained from Satu Data Indonesia, covering land area, production, productivity, and the number of farmers. The evaluation criteria include land area, production, productivity, and the number of farmers. In the decision-making process, a Decision Support System (DSS) approach is applied using the Multi-Attributive Border Approximation Area Comparison (MABAC) method and the Preference Selection Index (PSI). The MABAC method is used to determine rankings, while PSI is used for criteria weighting. The results indicate that sugarcane, tobacco, and robusta coffee are the best commodities, with final scores of 0.419, 0.237, and 0.020, respectively. Therefore, it can be concluded that the most potential commodities for development in Central Java are sugarcane, tobacco, and robusta coffee.

Keywords: central java; MABAC; plantation; PSI

Abstrak: Jawa Tengah memiliki potensi besar di sektor perkebunan dengan berbagai komoditas seperti lada, cengkeh, tembakau, teh, tebu, kopi, pala, dan nilam. Tetapi dengan banyaknya komoditas, tidak memastikan bahwa semua komoditas memberikan manfaat yang maksimal. Penilitian ini bertujuan membuat rekomendasi komoditas perkebunan yang paling potensial untuk dikembangkan. Penelitian ini menggunakan data perkebunan di Jawa Tengah dalam beberapa tahun terakhir yang diperoleh dari Satu Data Indonesia, mencakup luas lahan, produksi, produktivitas, jumlah petani. Kriteria evaluasi yang digunakan meliputi luas lahan, produksi, produktivitas, jumlah petani. Dalam proses pengambilan keputusan, digunakan metode SPK dengan pendekatan (MABAC) serta (PSI). Metode MABAC digunakan untuk menentukan peringkat, sementara PSI digunakan untuk pembobotan kriteria. Hasil yang diperoleh dari penilitian ini yaitu Tebu, Tembakau, Robusta merupakan tanaman terbaik dengan hasil akhir 0,419, 0,237, 0,020. Oleh karena itu, dapat disimpulkan tanaman yang dapat dikembangkan dengan potensial di wilayah Jawa Tengah dengan berbagai macam komoditas yaitu komoditas Tebu, Tembakau, dan Robusta.

Kata kunci: jawa tengah; MABAC; perkebunan ; PSI

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. XI No 2, Maret 2025, hlm. 313 – 320 ISSN 2550-0201 (Online)
DOI: http://dx.doi.org/10.33330/jurteksi.v11i2.3639
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

INTRODUCTION

Indonesia is a country with fertile land, so it can be utilized for various purposes, including the development of the plantation sector [1]. Central Java is known as one of the regions that has great potential in the plantation sector. Plantations are a branch of agriculture whose activities are mostly managed by individuals. The agricultural sector remains one of the main contributors in creating a large number of jobs, outperforming many other sectors in the Indonesian economy[2]. Various crops such as pepper, cloves, tobacco, tea, sugarcane, coffee, nutmeg, and patchouli, are an important part of supporting the local economy. Sugarcane is one of the leading plantation crops with the highest commercial value [3]. Despite the potential of sugarcane and other commodities, challenges such as land limitations, production fluctuations, and uneven numbers of farmers may hinder their benefits. Therefore, an analysis that considers the area planted, production, productivity, and number of farmers is needed to determine the most potential commodities to be developed.

This research uses the SPK approach. Decision Support System (DSS) is an interactive computer system that assists decision makers in processing data and various models to solve unstructured problems [4]. This system provides information, modeling, and data processing to support the decision-making process [5]. Decision Support Systems must use certain methods in the calculation process to assist in finding the correct solution [6]. One way that can be used to determine the type of plant is by applying the MABAC (Multi-Attributive Border Approximation Area Comparison) method, which serves to rank superior plantation crops in Central Java. The MABAC method is carried out through several stages, which include making a decision matrix, normalizing data, giving weights to criteria, determining boundary values, and calculating distances for each alternative [7]. In addition, the weight for each criterion is calculated using the Proximity-Scaled Importance (PSI) method which provides objective weighting results based on the proximity of data to a certain value.

This research uses four main criteria, namely, area, production, and productivity as benefit factors, and the number of farmers as cost factors. Previous studies have discussed the use of methods in decision support systems to determine superior commodities in the plantation sector. Research from [8] proved that this method is effective in assessing the best alternative based on the level of productivity and land suitability. On the other hand, the MABAC method has been applied in various studies, such as in [9], which shows its reliability in data-based decision making. Another study from [10]resulted in the MABAC and PSI methods when combined can make the results faster and more efficient.

Based on various previous findings, the MABAC method and PSI weighting have proven effective in decision-making in the plantation sector. This research develops a new approach in determining superior commodities in Central Java by applying both methods. This approach has never been studied before and is expected to provide more accurate recommendations to support

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. XI No 2, Maret 2025, hlm. 313 – 320 ISSN 2550-0201 (Online)
DOI: http://dx.doi.org/10.33330/jurteksi.v11i2.3639
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

optimal, targeted, and sustainable plantation management policies.

METHOD

The method used in this research consists of the stages of Data Collection, PSI Weighting, MABAC Calculation, and Rank Spearman Validation. The stages of the research method are shown.

Figure 1. Stages of the Method

Data Collection

The data source of this research is from the website satudata.go.id in 2020 with the title of data on area, production, productivity and the number of smallholder plantation farmers (PR) 16 plantation commodities.

PSI Method Weighting

The PSI method or Preference Selection Index is a technique used to overcome problems in the decision-making process with respect to a number of different criteria (Multi-Criteria Decision Making) [11]. In this research, the PSI method is used to determine the weighting with 6 steps.

Step 1: Create a decision matrix

$$X = \begin{bmatrix} X_{11} & \cdots & X_{12} & \cdots & X_{1n} \\ X_{21} & \cdots & X_{22} & \cdots & X_{2n} \\ X_{m1} & \cdots & X_{m2} & \cdots & X_{mn} \end{bmatrix} \quad (1)$$

Where n are criteria and m are alternatives.

Step 2: Normalize the decision matrix

Benefit Criteria:

$$\bar{x}_{ij} = \frac{x_{ij}}{x_{ij}^{max}} \quad (2)$$

Cost Criteria:

$$\bar{x}_{ij} = \frac{x_{ij}^{min}}{x_{ij}} \quad (3)$$

Where xij refers to the performance value of alternative i based on criterion j, Max indicates the highest value of the alternative, and Min indicates the lowest value of the alternative.Step 3: Determine the normalized average performance value.

$$N = \frac{1}{n}\sum_{i=1}^{m} \bar{x}_{ij} \quad (4)$$

The symbol N is the average performance, xij is the normalization matrix, and n is the alternative.

Step 4: Determining the value of preference variation

$$\emptyset_j = \sum_{i=1}^{m} \left(\bar{x}_{ij} - N\right)^2 \quad (5)$$

The symbol Øj means preference variation, N is the average performance, and xij is the normalization matrix.

Step 5: Determine the deviation of preference values

$$\Omega_j = 1 - \emptyset_j \quad (6)$$

Symbol Ωj is the deviation of preference value, Øj is the variation of preference.

Step 6: Determining criteria weights

$$W_j = \frac{\Omega_j}{\sum_{j=1}^{n} \Omega_j} \quad (7)$$

Where wj is the criterion weight, Ωj is the preference value deviation.

MABAC Method

MABAC is a technique for

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. XI No 2, Maret 2025, hlm. 313 – 320 ISSN 2550-0201 (Online)
DOI: http://dx.doi.org/10.33330/jurteksi.v11i2.3639
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

comparing multiple criteria. This approach was chosen because it provides a stable and reliable solution for logical decision making[12]. This method has 6 solution steps.

Step 1: Application of the MABAC Method to Support

$$X = \begin{matrix} A_1 \\ A_2 \\ A_3 \\ \cdots \\ A_n \end{matrix} \begin{pmatrix} C_1 & \cdots & C_n \\ X_{11} & \cdots & X_{mn} \\ X_{21} & \cdots & X_{mn} \\ X_{1m} & \cdots & X_{mn} \end{pmatrix} \quad (8)$$

Where n is the total number of criteria, m is the number of alternatives.

Step 2: Calculate (V), which is the weighted matrix element.

$$V_{ij} = \left(W_i \; x \; t_{ij}\right) + W_i \quad (9)$$

Where tij is the normalized matrix element (N), and wi represents the weight coefficient for each criterion.

Step 3: Determine (G), which is the border estimation area matrix.

$$g_i = \left[\prod_{j=1}^{m} V_{ij}\right]^{\frac{1}{m}} \quad (10)$$

Vij denotes (V) the weighted matrix elements and m reflects the total number of options available.

Step 4: Calculate (Q), which is the alternative distance matrix element of the approximate border area.

$$Q = V - G \quad (11)$$

V is the component of the weighted matrix and G is the matrix that describes the boundary estimation area.

Step 5: Ranking Alternatives (S)

$$S_i = \sum_{j=1}^{n} Q_{ij}, J = 1,2,\ldots n, i = 1,2 \ldots m$$

Where m are alternatives and n are criteria.

Spearman Rank Validation

The validation process is the process of comparing the results of the method with factual/occurrence data referred to as historical data.

RESULTS AND DISCUSSION

In the results and analysis section, there are solutions obtained by utilizing the various methods that have been established, including alternatives and their criteria.

Alternative and Criteria Data

In Table 1, there are 11 alternatives in the form of 11 names of plantation crops.

Table 1. Alternative Data

Code	Alternative
A1	Pepper
A2	Cloves
A3	Tobacco
A4	Tea
A5	Sugarcane
A6	Nutmeg
A7	Patchouli
A8	Robusta
A9	Arabica
A10	Cashew
A11	Cotton

The determination of the best estate crops is based on four criteria: area (Ha), production (Tons), productivity per hectare, and number of farmers. The me ntioned criteria are listed in Table 2.

Table 2. Criteria Data

Code	Criteria
C1	Area
C2	Production (Ton)
C3	Productivity (Kg/Ha)
C4	Number of Farmers

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. XI No 2, Maret 2025, hlm. 313 – 320 ISSN 2550-0201 (Online)
DOI: http://dx.doi.org/10.33330/jurteksi.v11i2.3639
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

The types of criteria, such as benefit or cost are listed in Table 3.

Type	Criteria
Benefit	Area
Benefit	Production (Ton)
Benefit	Productivity (Kg/Ha)
Cost	Number of Farmers

Benefits include area, production, and productivity as they contribute to increased yields and profits. Area reflects production potential, production indicates yield, and productivity measures land efficiency. In contrast, the number of farmers is considered a cost because the more labor required, the greater the cost to manage.

Assessment of alternatives for each criterion

Alternative data in Table 4 from the Satu Data Indonesia website is used to assess plantation commodities in Central Java based on area (C1), production (C2), productivity (C3), and number of farmers (C4). This data is the basis for applying the MABAC and PSI methods in determining potential superior commo dities.

Table 4. Alternative & Criteria Assessment

Alternative	C1	C2	C3	C4
A1	2116	630	558	13273
A2	39326	7381	309	199501
A3	106004	57643	1089	115814
A4	4537	6188	1528	27852
A5	79360	136637	3460	54154
A6	2606	212	307	9896
A7	551	20	69	1316
A8	38114	23280	770	187408
A9	8488	2719	614	26132
A10	24761	13347	774	115858
A11	4537	6188	1528	27852

Table 5. Normalization value

	C1	C2	C3	C4
A1	0,010	0,004	0,161	0,099
A2	0,186	0,042	0,089	0,007
A3	0,500	0,332	0,315	0,011
A4	0,021	0,036	0,442	0,047
A5	0,374	0,787	1,000	0,024
A6	0,012	0,001	0,089	0,133
A7	0,003	0,000	0,020	1,000
A8	0,180	0,134	0,223	0,007
A9	0,040	0,016	0,177	0,050
A10	0,117	0,077	0,224	0,011
A11	0,027	0,009	0,109	0,060
$\sum_{i=1}^{m} \bar{x}_{ij}$	1,470	1,438	2,849	1,451

PSI Method

The PSI method in this research is to determine the weight of each criterion which has 6 steps.

Application of Create a decision matrix

After knowing the alternative value, then make a decision matrix.

$$X = \begin{matrix} 2116 & 630 & 558 & 13273 \\ 39326 & 7381 & 309 & 19950 \\ 106004 & 57643 & 1089 & 11581 \\ \dots & \dots & \dots & \dots \end{matrix}$$

Normalization of the decision matrix

The following is the overall result of the decision matrix in Table 5.

Determining the average value of the normalized performance

Generates 4 average values of normalized performance.

$N_1 = \frac{1}{11} 1{,}470 = 0{,}134$

$N_2 = \frac{1}{11} 1{,}438 = 0{,}131$

Determination of preference variation values

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. XI No 2, Maret 2025, hlm. 313 – 320 ISSN 2550-0201 (Online)
DOI: http://dx.doi.org/10.33330/jurteksi.v11i2.3639
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

Furthermore, in determining the value of preventive variation, the overall results are shown in Table 6.

Table 6. Preference variation values

	C1	C2	C3	C4
A1	0,015	0,016	0,010	0,001
A2	0,003	0,008	0,029	0,016
A3	0,134	0,040	0,003	0,015
A4	0,013	0,009	0,033	0,007
A5	0,058	0,430	0,549	0,012
A6	0,015	0,017	0,029	0,000
A7	0,017	0,017	0,057	0,754
A8	0,002	0,000	0,001	0,016
A9	0,009	0,013	0,007	0,007
A10	0,000	0,003	0,001	0,015
A11	0,011	0,015	0,022	0,005
$\sum \emptyset_j$	0,277	0,568	0,742	0,846

Determination of deviation of preference values

There are 4 deviations of preference values and the sum of 4 deviations to determine the weight of each criterion.

$\Omega_j = 1 - 0{,}277 = 0{,}723$
$\Omega_j = 1 - 0{,}568 = 0{,}432$
$\Omega_j = 1 - 0{,}742 = 0{,}258$
$\Omega_j = 1 - 0{,}846 = 0{,}154$
$\sum \Omega_j = 1{,}567$

Determination of criteria weights

$W_1 = \frac{0{,}723}{1{,}567} = 0{,}461$
$W_2 = \frac{0{,}432}{1{,}567} = 0{,}275$

The calculation of PSI weighting results in the weight of each criterion. Criteria 1 has a weight of 0.461, criteria 2 has a weight of 0.257, criteria 3 has a weight of 0.165, criteria 4 has a weight of 0.099.

Calculation of weighted matrix elements (V)

The calculation results are in Table 7.

Table 7. Calculation of matrix elements

	C1	C2	C3	C4
A1	0,466	0,276	0,191	0,108
A2	0,547	0,287	0,180	0,099
A3	0,692	0,367	0,217	0,100
A4	0,471	0,285	0,238	0,103
A5	0,634	0,492	0,330	0,101
A6	0,467	0,276	0,179	0,112
A7	0,462	0,275	0,168	0,197
A8	0,544	0,312	0,202	0,099
A9	0,480	0,280	0,194	0,104
A10	0,515	0,297	0,202	0,100
A11	0,473	0,278	0,183	0,105

Determination of the border forecast area matrix (G)

Determination of this matrix according to the number of criteria, in this research there are 4 criteria so the number of border estimation area matrices is 4. Here is an example of the calculation of the 1st data and the results of the entire data are in Table 8.

Table 8. Border forecast area matrix

G	C1	C2	C3	C4
	0,518	0,306	0,204	0,109

Calculating the distance matrix eleme nts of alternatives to the approximate boundary area (Q)

In this analysis, the results and order of the ten choices and four criteria are determined. Here is an example of the calculation of the 1st data and the results of all data are in Table 9.

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. XI No 2, Maret 2025, hlm. 313 – 320 ISSN 2550-0201 (Online)
DOI: http://dx.doi.org/10.33330/jurteksi.v11i2.3639
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

Table 9. Final results

	C1	C2	C3	C4
A1	-0,052	-0,030	-0,013	-0,001
A2	0,029	-0,019	-0,024	-0,010
A3	0,174	0,060	0,013	-0,010
A4	-0,047	-0,021	0,034	-0,006
A5	0,116	0,186	0,126	-0,008
A6	-0,051	-0,031	-0,024	0,002
A7	-0,056	-0,031	-0,036	0,088
A8	0,026	0,006	-0,002	-0,010
A9	-0,038	-0,027	-0,010	-0,006
A10	-0,003	-0,010	-0,002	-0,010
A11	-0,045	-0,028	-0,021	-0,005

Alternative Ranking (S)

The last stage is to determine the ranking for each alternative and validate the Spearman Rank. The results of this ranking are contained in Table 10 and the ranking comparison using historical data. [13].

Table 10. Ranking results

Alternative	Rank	History
A1	9	9
A2	5	7
A3	2	2
A4	7	5
A5	1	1
A6	11	10
A7	6	11
A8	3	3
A9	8	8
A10	4	4
A11	10	6
Correlation Coefficient Spearman	0,77	

The results of the ranking are, the first to 3rd rankings are in alternative 5, alternative 3, and alternative 8. Meanwhile, the result of the Rank Spearman correlation coefficient is 0.77 which is listed in Table 11. The figure shows that both have a strong level of relationship.

CONCLUSION

This research shows that the MABAC method and PSI weighting are effective for determining superior planta tion commo dities in Central Java. Of the 11 commodities analyzed, the three best commodities are Sugarcane (score 0.419) due to land area and high productivity, Tobacco (score 0.237) with many farmers involved, and Robusta (score 0.020) due to stable production. Validation using Rank Spearman confirmed the accuracy of the method. This research can be expa nded by considering additional factors such as market price, export demand, as well as comparing the results with other methods such as TOPSIS or hybrid. The results of this research are expected to help the government and policy makers in designing more efficient, sustainable, and accurate data-based plantation managem ent strate gies.

BIBLIOGRAPHY

[1] N. M. Djafar, L. N. Wijayanti, A. R. Elprilita, and E. Widodo, "Pengelo mpokan Produksi Perkebunan Menurut Kabupaten/Kota Jawa Tengah Tahun 2020 Menggunakan Hierarchical Cluste ring," *Journal of Mathematics Education and Science*, vol. 4, no. 2, pp. 59–66, Oct. 2021, doi: 10.32665/james.v4 i2.230.

[2] M. Rojun and N. Nadziroh, "Peran Sektor Pertanian Dalam Pertumbuhan Ekonomi Di Kabupaten Magetan The Role Of The Agricultural Sector In Economic Growth In Magetan Distric," 2020.

[3] A. Dedy Syathori *et al.*, "Faktor-Faktor Yang Mempengaruhi Produksi Usaha tani Tanaman Tebu di Desa

Majangtengah Kecamatan Dampit Kabu paten Malang Factors That Influence The Production of Sugarcane Farming in Majangtengah Village, Dampit District, Malang Regency," 2020.

[4] D. O. Wibowo and A. Thyo Priandika, "Sistem Pendukung Keputusan Pemilih an Gedung Pernikahan Pada Wilayah Bandar Lampung Menggunakan Metode Topsis," *Jurnal Informatika dan Rekayasa Perangkat Lunak (JATIKA)*, vol. 2, no. 1, p. page-page. xx~xx, 2021, [Online]. Available: http://jim.teknok rat.ac.id/index.php/informatika

[5] B. Nur Ihwa, N. Silalahi, and R. Kristianto Hondro, "Sistem Pendukung Keputusan Pemilihan Jaksa Terbaik dengan Menerapkan Metode MABAC (Studi Kasus: Kejaksaan Negeri Medan)," *Journal of Computer System and Informatics (JoSYC)*, vol. 1, no. 4, pp. 225–230, 2020.

[6] N. Ndruru, F. Tinus Waruwu, and D. Putro Utomo, "RESOLUSI : Rekayasa Teknik Informatika dan Informasi Penerapan Metode MABAC Untuk Mendukung Pengambilan Keputusan Pemilihan Kepala Cabang Pada PT. Cefa Indonesia Sejahtera Lestari," *Media Online)*, vol. 1, no. 1, pp. 36–49, 2020, [Online]. Available: https://djournals. com/resolusi

[7] H. Pasaribu and R. Amanda Putri, "Implementasi Metode MABAC Untuk Menentukan Siswa Yang Layak Mene rima Beasiswa PIP SDN," *Journal of Information System Research (JOSH)*, vol. 5, no. 4, pp. 1342–1351, 2024, doi: 10.47065/josh.v5i4.5347.

[8] M. Hutagalung, K. Erwansyah, M. Zunaidi, P. Studi Mahasiswa, S. Triguna Dharma, and P. Studi Dosen Pembim bing, "Sistem Pendukung Keputusan Pemilihan Bibit Unggul Pada Tanaman Tembakau (Nicotiana Tabacum) Mengg unakan Metode Moora(Multi Objective Optimizion On The Basis Of Ratio Analysis)," *Jurnal CyberTech*, vol. x. No.x, [Online]. Available: https://ojs .trigunadharma.ac.id/

[9] S. R. Cholil, E. P. Rachmawati, and S. Asmiatun, "Sistem Pendukung Keputu san Pemberian Reward dan Punishment pada Perusahaan Makanan Mengguna kan Metode MABAC," *Jurnal Rekayasa Sistem & Industri (JRSI)*, vol. 9, no. 02, p. 79, Dec. 2022, doi: 10.251 24/jrsi.v9i02.542.

[10] S. Salma, N. Maftucha, and S. R. Cholil, "Sistem Pendukung Keputusan Penerima Bantuan Warga Miskin Dari Baznas Kota Semarang Menggunakan Metode Mabac Dengan Pembobotan Psi," 2024.

[11] N. Putri Rizanti, L. T. Sianturi, and M. Sianturi, *Seminar Nasional Teknologi Komputer & Sains (SAINTEKS) Sistem Pendukung Keputusan Pemilihan Siswa Pertukaran Pelajar Menggunakan Metode PSI (Preference Selection Index)*. [Online]. Available: https ://seminar-id.com/semnas-sainteks2019.html

[12] R. A. A. S. Prayoga, F. Nusyura, and Y. Setiawan, "Implementasi Sistem Pendu kung Keputusan Untuk Memilih Café Dengan Metode Mabac," *JIKO (Jurnal Informatika dan Komputer)*, vol. 7, no. 2, p. 279, Sep. 2023, doi: 10.2679 8/jiko.v7i2.869.

[13] S. R. Cholil, R. Gernowo, and C. E. Widodo, "A Novel BED: BWM-Entro py-D Numbers as Determinants of Sustainable Entrepreneurship in MSM Es," *IEEE Access*, 2024, doi: 10.1109/ACCESS.2024.3491838.